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VIA EMAIL

Mr. Joseph Karkoski
Mr. Daniel MacClure
Central Valley Regional Water Quality Control Board
Sacramento Main Office
11020 Sun Center Drive, #200
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Re: Water Quality Control Plan Amendments for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento-San Joaquin Delta

Gentlemen:

Because it may not be possible for a representative of our client, Makhteshim Agan of North America, Inc. ("MANA"), to attend the April 27 workshop on the referenced Basin Plan amendments, we thought it would be useful to present here several observations on the January 2006 Peer Review Draft Report.

1. The Water Board Should Adopt USEPA's Diazinon Water Quality Criteria as the Basin Plan Numeric Water Quality Objectives.

As you know, MANA has long believed that it would make the most sense for numeric water quality objectives to be determined using probabilistic methods that reflect actual field conditions. We also recognize, however, that the Regional and State Boards have chosen to rely on the more traditional, toxicity-based calculations.

MANA also recognizes that the current draft report takes into account the data reporting error that was identified during development of the Sacramento-Feather River Basin Plan amendment process, and seeks to correct it. The Board staff is to be commended for doing so.

However, since the draft report was prepared, USEPA has published a final Aquatic Life Ambient Water Quality Criteria. (EPA-822-R-05-0006 (December 2005)). Based on a comprehensive review of the available data (and recognizing the error in reporting the notorious 1980 *Gammarus fasciatus* study), USEPA adopted identical 170 ng/L acute and chronic standards. MANA believes the USEPA analysis was thorough and reflects the most comprehensive evaluation of available data. MANA thus urges that, if the Boards continue to rely on a toxicity-based calculation to set

the numeric diazinon water quality objectives, 170 ng/L be adopted as both the acute and chronic objective.

2. The Sholtz Study Does Not Provide a Basis for Establishing or Adjusting the Diazinon Water Quality Objective.

The draft report notes the need for the Board to consider "other available information" when interpreting narrative objectives, and references comments of NOAA Fisheries that, in turn, were based on a report by Scholz, et, al. (2000). (Draft Report, p. 45). It also refers to the same study in discussing Endangered Species Act concerns (Draft Report, p. 65). At that point, the report notes that "Regional Water Board staff agrees [with Dr. Felsot] that the results of the Scholz study cannot be used directly for diazinon criteria derivation, although the study does raise concerns regarding sublethal effects of diazinon on endangered salmonids."

MANA believes that even this cautious statement gives too much weight to the Sholtz study. Careful review of that report shows that its conclusions are wholly unreliable.

For example, one objective of the Sholtz research was to provide a live feed source to control and diazinon-exposed juvenile salmon, then record their behavioral responses before and after releasing a diluted extract of chinook salmon skin. The control fish appeared to reduce their movements and feeding more than the diazinon-exposed fish. But several assumptions underlying the report's analysis are dubious. One is that chinook skin extract contains alarm substances or information indicating that predators are present and that fish should react by freezing and reducing their level of activity. A second assumption is that an impaired sensed of smell (conceivably due to diazinon) would block olfactory cues of danger, causing the fish to continue to feed uninterrupted and leading to a significantly increased risk of predation. Yet a third is that fish from each treatment were tested at random times during the day and that appetite was not a factor as to whether salmon chose to continue feeding at the same rate or not.

With regard to the claim by the authors that the responses of juvenile salmon to the odor of skin extracts is an "anti-predator" reaction that has the potential of affecting the survival of fish at the population level is a big logical jump in the interpretation

of the actual data. To date, no researcher (including, but not limited to Scholz) has identified any specific compounds unique to chinook salmon skin that are related to the well-documented alarm substances in other species of fish. Therefore, evidence of alarm substances in chinook skin is still purely circumstantial and without solid foundation. For all anyone knows, the reduction in feeding activity by the control fish was in anticipation of receiving larger fishmeal-based pelleted feed given to these fish during their earlier holding periods. It also is still an open question as to why these "threatened" fish never chose to make use of the available cover provided them or exhibit darting (burst swimming) avoidance behaviors that are well known predator avoidance techniques.

The unreliability of the second assumption is revealed by analysis of the tank size and water level used in the feeding tests. Scholz used 170-liter tanks filled to a height of only 25 cm (10 inches) for a total volume of approximately 105 liters. The published flow rate of 6 liters/minute permits a calculation that the removal and replacement of the total volume of water would take approximately 17 minutes. Given that daphnia (the live food source) are unable to swim far against the current, passive removal of 50% of them would occur by the end of the 8-minute pre-stimulus observation period (plus the 2-minute interval allowed before data collection). Therefore, a substantial reduction in food strikes per minute would happen naturally after this 10-minute period, even without an olfactory stimulus, because there would be less daphnia available.

Put another way, the number of daphnia left to elicit food strikes will be directly related to the total starting number added to the water inlet tube. Unfortunately, this was not estimated (or reported) in the Sholtz paper. Random, higher starting numbers of daphnia might be expected to result in higher percent activity and thus more frequent food strikes per minute during the post-stimulus observation period. If so, this would influence the results independently of any diazinon pre-treatment. This is potentially a large source of error.[1]

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[1] In support of this contention, the graphs in Figure 3 of the Scholz study are notable in that no comparison is shown between the pre- and post-stimulus differences, even though differences clearly occurred in the diazinon-exposed fish. Changes from over 90% activity to levels averaging between 30 and 47% activity taken from the data provided in the study's Figure 4 are likely to be significantly different for all of the treatment groups (not just the controls). Therefore, the diazinon-exposed fish still exhibited substantial declines in activity and number of food strikes on daphnia following the conspecific odor stimulus.

Finally, if, like many toxicologists, the researchers started their tests with unexposed control fish, or lower concentration diazinon-treated fish, they might have inadvertently biased their results. Such an approach might be used if the researchers felt that residues from exposed fish might contaminate the subsequent test tank systems, or if time would be saved by using control fish first because no post-treatment recovery period is needed. If the controls were tested before other treatments, then there is the potential that the appetites of the fish would be less than fish used later in the day. In this scenario, exposed fish would be hungrier and might not stop foraging after receiving skin extracts even though they might be able to smell them perfectly well. Furthermore, there is no information that would indicate that increased feeding activity in the presence of conspecific scents would necessarily be detrimental to the survival of an individual fish or to the health of a population of salmon. In fact, it is well known that high feeding and growth rates are directly correlated with increased fitness in juvenile salmon entering the sea (Dill et al. 1981).

There also are serious problems with the portion of the Scholz report that deals with homing behavior. The fact that the authors chose to put the results into percent return relative to controls makes it appear that the differences between them are large without reminding the reader that the actual return rate of the control fish was only a dismal 16 of 40 fish released. Considering that the distance to return was only 2 kilometers, it is certainly possible that many other factors were involved in the return rate.

For example, it is well known that sexually mature chinook salmon are often infected with large numbers of debilitating *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease (Elliott and Pascho 2001; McKibben et al. 2005). In addition, the salmon were collected over a long period (October 9th – November 10th) and may have been at various stages of sexual maturation during the experimental exposure prior to release. Since all Pacific salmon die after sexual maturity and spawning, this is an important uncontrolled factor in the analysis.

In short, the Regional Board staff's caution in relying on the Scholz study in setting numerical criteria is well-founded. In fact, however, the study is too unreliable even to merit the limited acknowledgement of it set forth at page 65 of the Staff Report.

3. Additivity

As Dr. Felsot has pointed out in his peer review comments on this draft report and on the Sacramento-San Joaquin report, additivity of toxic effects does not appear to occur at the levels of diazinon and chlorpyrifos found in Delta waterways. Nor does the data support the purportedly synergistic effect of atrazine at the levels present. MANA thus urges that the draft report be revised to reflect the lack of any well-founded concern about additivity.

Conclusion

MANA appreciates your attention to and consideration of these comments in preparation final recommendations to the Regional Board. If you have any questions regarding MANA's position, please contact me.

Sincerely,

David B. Weinberg

cc: Ephi Gur
Bryan Stuart

References:

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